ATTACHMENT F: EMERGENCY AND REMEDIAL RESPONSE PLAN 40 CFR 146.94(a)
CLEAN ENERGY SYSTEMS MENDOTA

1. Facility Information

Facility name:	CLEAN ENERGY SYSTEMS MENDOTA MENDOTA_INJ_1
Facility contact:	Rebecca Hollis 400 Guillan Park Drive, Mendota, CA 93640 Office: 916-638-7967
Well location:	MENDOTA, FRESNO COUNTY CA T13S R15E S32 LAT/LONG COORDINATES (36.75585015/–120.36440423)

This Emergency and Remedial Response Plan (ERRP) describes actions that Clean Energy Systems shall take to address movement of the injection fluid or formation fluid in a manner that may endanger an underground source of drinking water (USDW) during the construction, operation, or post-injection site care periods.

If Clean Energy Systems obtains evidence that the injected CO_2 stream and/or associated pressure front may cause an endangerment to a USDW, Clean Energy Systems must perform the following actions:

1. Initiate shutdown plan for the injection well.
2. Take all steps reasonably necessary to identify and characterize any release.
3. Notify the permitting agency (UIC Program Director) of the emergency event within 24 hours.
4. Implement applicable portions of the approved ERRP.

Where the phrase "initiate shutdown plan" is used, the following protocol will be employed: Clean Energy Systems will immediately cease injection. However, in some circumstances, Clean Energy Systems will, in consultation with the UIC Program Director, determine whether gradual cessation of injection (using the parameters set forth in Attachment A of the Class VI permit) is appropriate.

This attachment is one of the several documents listed below that was prepared by Schlumberger and delivered to Clean Energy Systems. These documents were prepared to support the Clean Energy Systems preconstruction application to the EPA.

- Attachment A: Summary of Requirements Class VI Operating and Reporting Conditions (Schlumberger, 2021a)
- Attachment B: Area of Review and Corrective Action Plan (Schlumberger, 2021b)

- Attachment C: Testing and Monitoring Plan (Schlumberger, 2021c)
- Attachment D: Injection Well Plugging Plan (Schlumberger, 2021d)
- Attachment E: Post-Injection Site Care and Site Closure Plan (Schlumberger, 2021e)
- Attachment F: Emergency and Remedial Response Plan (Schlumberger, 2021f)
- Attachment G: Construction Details Clean Energy Systems Mendota (Schlumberger, 2021g)
- Attachment H: Financial Assurance Demonstration (Schlumberger, 2021h)
- Class VI Permit Application Narrative 40 CFR 146.82(A) Clean Energy Systems Mendota (Schlumberger, 2021i)
- Schlumberger Quality Assurance and Surveillance Plan (Schlumberger, 2021j)

Contents

1.1 Abbreviations

AoR: Area of review

CES: Clean Energy Systems

EPA: Environmental Protection Agency

ERRP: Emergency and remedial response plan

Mendota_INJ_1: Proposed CO_2 injection well

MIT: Mechanical integrity test

UIC: Underground injection control

USDW: Underground sources of drinking water

USGS: US Geological Survey

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2. Local Resources and Infrastructure

Resources in the vicinity of the Clean Energy Systems Mendota that may be affected as a result of an emergency event at the project site include

- Underground sources of drinking water (USDWs) and water wells within the 2.5-mile radius of the proposed injection location. There are approximately 79 ground water monitoring and irrigation wells and 5 abandoned wells within the radius. A map displaying the locations of these wells can be found in the Class IV Permit Application Narrative (Schlumberger, 2021i) . The depth of the water wells within the 2.5-mile radius range from 20 to 550 ft. The San Joaquin River flows north-south and is 0.6 miles due east of the site.
- The northern boundary of the Mendota Wildlife Area is 1.7 miles to the south. Managed by the California Department of Fish and Wildlife, the Mendota Wildlife Area is approximately 11,800 acres consisting of flatlands and floodplain.

Infrastructure in the vicinity of the Clean Energy Systems Mendota that that may be affected as a result of an emergency at the project site include the town of Mendota, CA:

- The town of Mendota, CA is due west of the site. Mendota is a town in Fresno County. The population was 11,014 at the 2010 U.S. Census (U. S. Census Bureau, n.d.). It covers 3.3 square miles and has approximately 2,750 households. The nearest residence to the site is 0.5 miles west and outside the AoR. Mendota is located 8.5 miles south-southeast of Firebaugh, at an elevation of 174 ft. Between the site and the town are several businesses, including Gonzales Transport and airstrip (1,500 ft) west. There is also the King Kool cold storage facility and Oro Loma Ranch/Ruby Fresh, a pomegranate marketing firm. Mendota High School is 0.7 miles southwest. Southern Power's North Star solar facility borders on the north of the site and is a 61-megawatt facility located on 626 acres.

Resources and infrastructure addressed in this plan are shown in Figure 1.

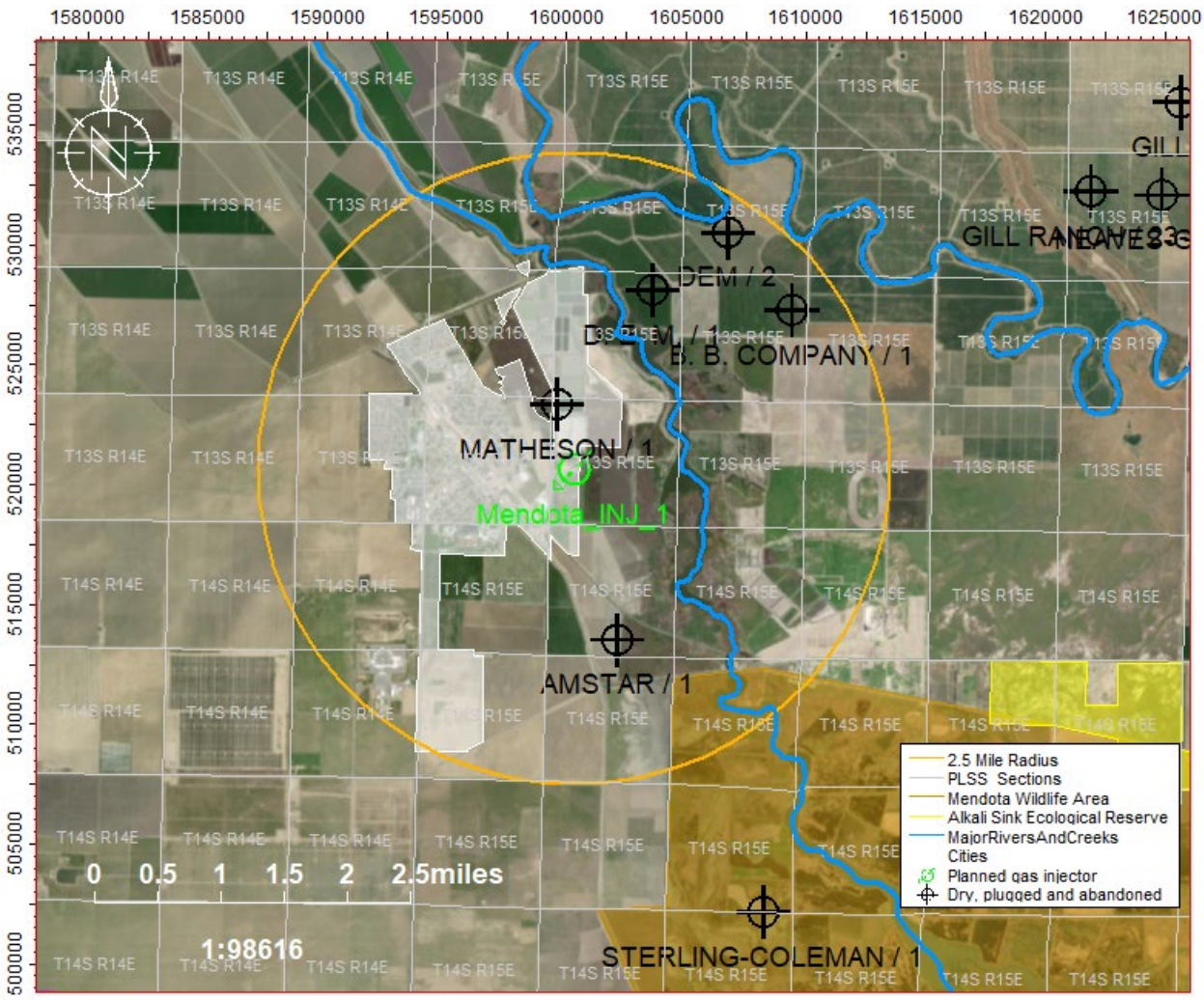

Figure 1: Location of the proposed Mendota_INJ_1 CO_2 injection well and surrounding plugged wells. Orange circle denotes 2.5-mile radius around the proposed injection well. The town of Mendota is shaded in white, the Mendota Wildlife Area is shaded in orange, and the Alkali Sink Ecological Reserve is shaded in yellow. Data from IHS (2020) California Department of Fish and Wildlife (2021), California State Geoportal (2021), California Open Data Portal (2019), and California Natural Resources Agency (2021).

3. Potential Risk Scenarios

The following events related to the Clean Energy Systems Mendota could potentially result in an emergency response:

- Overpressurized fluid (blowout) during well construction
- Injection or monitoring (verification) well integrity failure
- Injection well monitoring equipment failure (e.g., shutoff valve or pressure gauge, etc.)

- A natural disaster (e.g., earthquake, tornado, lightning strike)
- Fluid (e.g., brine) leakage to a USDW
- CO_2 leakage to USDW or to land surface
- Induced seismic event

Response actions will depend on the severity of the event(s) triggering an emergency response. "Emergency events" are categorized as shown in Table 1.

Table 1. Degrees of risk for emergency events.

Emergency Condition	Definition
Major emergency	Event poses immediate substantial risk to human health, resources, or infrastructure. Emergency actions involving local authorities (evacuation or isolation of areas) should be initiated.
Serious emergency	Event poses potential serious (or significant) near-term risk to human health, resources, or infrastructure if conditions worsen, or no response actions taken.
Minor emergency	Event poses no immediate risk to human health, resources, or infrastructure.

4. Emergency Identification and Response Actions

Steps to identify and characterize the event will depend on the specific issue identified and the severity of the event. The potential risk scenarios that were identified in section 3 are detailed below.

4.1 Overpressurized Fluid (Blowout) During Well Construction

This event could occur during well drilling if a pocket of high-pressure gas or fluid is encountered or due to an operational error or equipment failure. For further details please refer to Risk Register Scenario number 1a (Appendix A: CES Project Preliminary Risk Register).

Severity: Catastrophic

Timing of event: Pre-injection and injection

Avoidance measures: Monitoring and training

Detection methods: Pressure monitoring, injection rate decreasing, and fluid leaks

Potential response actions:

- Limit access to wellhead to authorized personnel only.
- Cease drilling operations to prevent loss of drilling fluid due to lost circulation and/or drilling into an overpressured formation.

- Close flow valve (blowout preventer) if pressures and flows permit; at a minimum, vent to a controlled area.
- Regain pressure control by restoring fluid levels in the wellbore with appropriate density mud, restriction of flow through choke, or both.
- For a Major or Serious emergency:
    - Initiate well control procedures (see well plan).
    - Alert local fire and police and UIC Program Director immediately.
- For a Minor emergency:
    - Regain pressure control by restoring fluid levels in the wellbore with appropriate density mud, restriction of flow through choke, or both.
    - Determine the cause of the event and initiate remediation procedures.
    - Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).

Response personnel: Site operator, well engineer, and project manager

Equipment: Pressure control equipment, pumping equipment, and rig

4.2 Well Integrity Failure

Integrity loss of the injection well and/or verification well may endanger USDWs. Examples of well integrity failure include scenarios related to wellhead pressure, annulus pressure, mechanical integrity, and failure of monitoring equipment. For further details please refer to Risk Register scenario numbers 2a, 2b, and 2c (Appendix A: CES Project Preliminary Risk Register).

Integrity loss may be indicated if the following events occur:

1. Wellhead pressure exceeds the specified shutdown pressure specified in the permit.
2. Annulus pressure indicates a loss of external or internal well containment.
3. Mechanical integrity test results identify a loss of mechanical integrity.

Automatic shutdown devices are activated when

- Wellhead or downhole pressures exceed the specified shutdown pressure specified in the permit.
- Annulus pressure and/or fluid volumes indicate a loss of external or internal well containment.
- Mechanical integrity test results identify a loss of mechanical integrity.

Pursuant to 40 CFR 146.91(c)(3), Clean Energy Systems must notify the UIC Program Director within 24 hours of any triggering of a shutoff system (i.e., downhole or at the service).

Severity: Light, serious, or catastrophic

Timing of event: Injection/monitoring

Avoidance measures: Well maintenance, injection within permitted limits, and monitoring

Detection methods: Pressure monitoring and mechanical integrity tests

Potential response actions:

- Limit access to wellhead to authorized personnel only.
- Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).
- Determine the severity of the event, based on the information available, within 24 hours of notification.
- For a Major or Serious emergency (verified loss or increase of pressure or fluid volumes and/or loss of mechanical integrity during testing and maintenance)
    - Initiate immediate shutdown plan.
    - Shut in well (close flow valve) after verifying pressures, with analog gauges, to confirm no damage will occur to the well or USDW.
    - Monitor well pressure, temperature, and acoustics to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).
    - Vent fluids, if necessary, from the wellhead to maintain acceptable pressures at surface and downhole to prevent damage to the wellhead or casing.
    - Communicate with CES personnel and local authorities to initiate evacuation plans, as necessary.
    - If contamination is detected, identify and implement appropriate remedial actions (in consultation with the UIC Program Director).
    - Conduct assessment to determine whether there has been a loss of mechanical integrity.
    - Identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).
    - If there is damage to the wellhead, repair the damage and conduct a survey to ensure wellhead leakage has ceased.
    - Confirm well integrity prior to restarting injection (upon approval of the UIC Program Director).
    - Review downhole, wellhead, and annulus pressure data.
    - Isolate the nearby area, if needed; establish a safe distance and perimeter using a hand-held air-quality monitor.
    - Perform a well log/mechanical integrity test (MIT) to detect CO_2 movement outside of the casing.

- For a Minor emergency (downhole and surface sensor/monitoring equipment failure, procedural maintenance error or plant issue)
    - Initiate immediate shutdown plan.
    - Monitor well pressure, temperature, and acoustics to verify integrity loss and determine the cause and extent of failure; use analog gauges to identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).
    - If a shut off is triggered by mechanical or electrical malfunctions without endangering a USDW, repair faulty components.
    - Review downhole, wellhead, and annulus pressure data.
    - Confirm well integrity prior to restarting injection (upon approval of the UIC Program Director).
    - If contamination is detected or well integrity has been determined to have occurred, then the situation becomes a Major or Serious emergency. Refer to Major or Serious solutions above.

Response personnel: Site operator, well engineer, and project manager

Equipment: Workover rig or coiled tubing unit, wireline, slickline, and well control equipment

4.3 Injection Well Monitoring Equipment Failure

The failure of monitoring equipment for wellhead/downhole pressure, temperature, and/or acoustics may indicate a problem with the injection well that could endanger USDWs. Additionally, equipment failures (sensor, computer, cabling, etc.) and damage to the wellhead could endanger the USDW. For further details, please refer to Risk Register scenario numbers 3a and 3b (Appendix A: CES Project Preliminary Risk Register).

Severity: Light to catastrophic

Timing of event: Injection/monitoring

Avoidance measures: Well maintenance, injection within permitted limits, and monitoring

Detection methods: Equipment monitoring

Potential response actions:

- Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).
- Determine the severity of the event, based on the information available, within 24 hours of notification.
- Limit access to wellhead to authorized personnel only.
- For a Major or Serious emergency (failure of sensors that will require shutdown of well to repair, extended repair time of >48 hours, and/or well reentry to fix problem):
    - Initiate immediate shutdown plan.

  - Monitor well pressure, temperature, and acoustics to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).
  - Review downhole and wellhead pressure, temperature, and acoustic data.
  - Evaluate pressures and conditions via analog gauges to determine no damage to wellbore, wellhead, or USDW will occur.
  - Shut in well (close flow valve or allow packer fluid into reservoir, fill hole).
  - Vent fluids from wellbore and surface facilities.
  - Communicate with CES personnel and local authorities to initiate evacuation plans, as necessary.
  - Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).
  - If contamination is detected, identify and implement appropriate remedial actions (in consultation with the UIC Program Director).
  - Isolate the nearby area, if needed; establish a safe distance and perimeter using a hand-held air-quality monitor.
  - Perform a well log/MIT to detect CO_2 movement outside of the casing.

- For a Minor emergency (sensor or monitoring failure that does not require shutdown of well to repair)
  - Monitor well pressure, temperature, and acoustics to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).
  - Conduct assessment to determine whether there has been a loss of mechanical integrity.
  - If there has been a loss of mechanical integrity, continue shutdown plan and refer to Major or Serious emergency guidelines.
  - Reset automatic shutdown devices.
  - Evaluate the cause of the failure, and mitigate if necessary (i.e., repair equipment).
  - Confirm well integrity prior to restarting injection and upon approval of the UIC Program Director.

Response personnel: Site operator, well engineer, technician(s) for monitoring equipment and project manager

Equipment: Workover rig, wireline, backup monitoring equipment

4.4 Potential Brine or CO_2 Leakage to USDW

A problem may be indicated if elevated concentrations of indicator parameter(s) are seen in groundwater sample(s) or there is other evidence of fluid (brine) or CO_2 leakage into a USDW. This scenario will encompass any evidence of CO_2 or fluid movement out of the injection zone (i.e., not necessarily to a USDW) to address unanticipated events associated with faults or other pathways, any potential USDW endangerment/unacceptable changes in water quality, and CO_2 leakage to the land surface. For further details, please refer to Risk Register scenario numbers 4a and 4b (Appendix A: CES Project Preliminary Risk Register).

To better protect the USDW and to have an early warning system for USDW impact, it is important to monitor out-of-zone CO_2 migration above the storage complex. The technology that is planned to be used to identify and quantify the severity of a potential brine or CO_2 leakage to USDW is described in the testing and monitoring plan (Schlumberger, 2021c).

Severity: Catastrophic

Timing of event: Pre-injection, injection, and/or post-injection phases

Avoidance measures: Well maintenance, injection within permitted limits, and monitoring

Detection methods: Fluid sampling and atmospheric and subsurface monitoring

Potential response actions:

- Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).
- Determine the severity of the event, based on the information available, within 24 hours of notification.
- Limit access to wellhead to authorized personnel only.
- For all emergencies (Major, Serious, or Minor):
    - Initiate shutdown plan.
    - If the presence of indicator parameters is confirmed, develop (in consultation with the UIC Program Director) a case-specific work plan to
        - Install additional groundwater monitoring points near the affected groundwater well(s) to delineate the extent of impact; and
        - Remediate unacceptable impacts to the affected USDW.
    - Perform pressure and surface monitoring and periodic visual inspection.
    - Arrange for an alternate potable water supply, if the USDW was being utilized and has been caused to exceed drinking water standards.
    - Proceed with efforts to remediate USDW to mitigate any unsafe conditions (e. g., install system to intercept/extract brine or CO_2 or “pump and treat” to aerate CO_2-laden water).

- Continue groundwater remediation and monitoring on a frequent basis (frequency to be determined by Clean Energy Systems and the UIC Program Director) until unacceptable adverse USDW impact has been fully addressed.

- If there is a well integrity issue, specific steps will be taken to identify the location of the failure/leak, affect repairs, and demonstrate mechanical integrity.

- If the leak poses a risk to air quality the nearby area will be isolated, and a safe distance and perimeter will be established using a hand-held air-quality monitor.

Response personnel: Site operator, groundwater consultant, and project manager

Equipment: Groundwater remediation equipment

4.5 Natural Disaster

Well problems (integrity loss, leakage, or malfunction) may arise as a result of a natural disaster affecting the normal operation of the injection well. An earthquake may disturb surface and/or subsurface facilities, and weather-related disasters (e. g., tornado or lightning strike) may affect surface facilities. For further details please refer to Risk Register scenario number 5a (Appendix A: CES Project Preliminary Risk Register).

Severity: Catastrophic

Timing of event: Pre-injection, injection, and/or post-injection phases

Avoidance measures: Meteorological monitoring

Detection methods: Microseismic monitoring and meteorological monitoring

Potential response actions:

- Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).
- Determine the severity of the event, based on the information available, within 24 hours of notification.
- Limit access to wellhead to authorized personnel only.
- For a Major or Serious emergency:
  - Initiate immediate shutdown plan. Shut in well (close flow valve).
  - Vent CO_2 from surface facilities if appropriate.
  - Communicate with CES personnel and local authorities to initiate evacuation plans, as necessary.
  - Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate

remedial actions to repair damage to the well (in consultation with the UIC Program Director).

- Determine if any leaks to groundwater or surface water occurred.
- If contamination is detected, identify and implement appropriate remedial actions (in consultation with the UIC Program Director).

- For a Minor emergency:
  - Conduct assessment to determine whether there has been a loss of mechanical integrity.
  - If there has been a loss of mechanical integrity, initiate immediate shutdown plan.
  - If there has not been a loss of mechanical integrity, initiate gradual shutdown.
  - Shut in well (close flow valve).
  - Vent CO_2 from surface facilities if appropriate.
  - Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).

Response personnel: Site operator and groundwater consultant

Equipment: To be determined immediately following natural disaster

4.6 Induced or Natural Seismic Event

Based on the project operating conditions, it is highly unlikely that injection operations would ever induce a seismic event. Simulations show extremely small pressure increase produced by the planned injection into the Second Panoche formation. Therefore, this portion of the response plan is developed for any seismic event with an epicenter within a 0.5-mile radius of the injection well.

To monitor the area for seismicity, an optical cable will be installed in the above-confining-zone monitor well (Mendota_ACZ_1) with digital acoustic sensing (DAS). The DAS fiber cable will monitor continuously and be recorded by a surface recording system. The recording system will be programmed to identify induced seismic events in real time to automatically send alerts to site safety personnel.

Based on the periodic analysis of the monitoring data, observed level of seismic activity, and local reporting of felt events, the site will be assigned an operating state. The operating state is determined using threshold criteria, which correspond to the site's potential risk and level of

seismic activity. The operating state provides operating personnel information about the potential risk of further seismic activity and guides them through a series of response actions.

The seismic monitoring system structure is presented in Table 2. The table corresponds each level of operating state with the threshold conditions and operational response actions. For further details please refer to Risk Register scenario numbers 6a, 6b, 6c, 6d and 6e (Appendix A: CES Project Preliminary Risk Register).

Severity: Light, Major, or Catastrophic

Timing of event: Pre-injection, injection, and/or post-injection phases

Avoidance measures: Injection within permitted limits

Detection methods: Microseismic monitoring

Potential response actions: Response actions are shown in Table 2.

Response personnel: Site operator and microseismic provider

Equipment: Microseismic monitoring and falloff test

Table 2. Seismic monitoring system, for seismic events > M1.0 with an epicenter within a 0.5-mile radius of the injection well.

Operating State	Threshold Condition[1,2]	Response Action[3]
Green	Seismic events less than or equal to M1.5	1. Continue normal operation within permitted levels. 2. Document the event for reporting to EPA in semiannual reports.
Yellow	Five (5) or more seismic events within a 30-day period having a magnitude greater than M1.5 but less than or equal to M2.0	1. Continue normal operation within permitted levels. 2. Initiate gradual shutdown of the well if it is determined to be appropriate. 3. Within 24 hours of the incident, notify the UIC Program Director of the operating status of the well. 4. Review seismic and operational data to determine location and magnitude of seismic event. If the event falls within or near the extents of the plume, use the microseismic, geomechanics and facies data to estimate potential impact to USDWs. Perform a pressure falloff test to determine if the storage complex has been compromised by the seismic event. 5. Document the event for reporting to EPA in semiannual reports.
Orange	Seismic event greater than M1.5 and local observation or felt report Seismic event greater than M2.0 and no felt report	1. Continue normal operation within permitted levels. 2. Initiate gradual shutdown of the well if it is determined to be appropriate. 3. Within 24 hours of the incident, notify the UIC Program Director, of the operating status of the well. 4. Review seismic and operational data to determine location and magnitude of seismic event. If the event falls within or near the extents of the plume, use the microseismic, geomechanics and facies data to estimate potential impact to USDWs. Perform a pressure falloff test to determine if the storage complex has been compromised by the seismic event. 5. Report findings to the UIC Program Director and issue corrective actions. 6. Document the event for reporting to EPA in semiannual reports.

[1] Specified magnitudes refer to magnitudes determined by local Clean Energy Systems or USGS seismic monitoring stations or reported by the USGS National Earthquake Information Center using the national seismic network.

[2] "Felt report" and "local observation and report" refer to events confirmed by local reports of felt ground motion or reported on the USGS "Did You Feel It?" reporting system.

[3] Reporting findings to the UIC Program Director and issuing corrective action will occur within 25 business days (five weeks) of change in operating state.

Operating State	Threshold Condition[1,2]	Response Action[3]
Magenta	Seismic event greater than M2.0 and local observation or report	1. Limit access to wellhead to authorized personnel only. 2. Initiate gradual shutdown of the well if it is determined to be appropriate. 3. Within 24 hours of the incident, notify the UIC Program Director, of the operating status of the well. 4. Communicate with facility personnel and local authorities to initiate evacuation plans, as necessary. 5. Monitor well pressure, temperature, and annulus pressure to verify well status and determine the cause and extent of any failure; identify and implement appropriate remedial actions (in consultation with the UIC Program Director). 6. Determine if leaks to ground water or surface water or a CO_2 leak to the surface occurred. 7. If a CO_2 leak or USDW contamination/endangerment is detected: a. Notify the UIC Program Director within 24 hours of the determination and implement appropriate remedial actions in consultations with the Director. 8. Review seismic and operational data to determine location and magnitude of seismic event. If the event falls within or near the extents of the plume, use the microseismic, geomechanics and facies data to estimate potential impact to USDWs. Perform a pressure falloff test to determine if the storage complex has been compromised by the seismic event. 9. Report findings to the UIC Program Director and issue corrective actions. 10. Document the event for reporting to EPA in semiannual reports.
Red	Seismic event greater than M2.0, and local observation or report, and local report and confirmation of damage[4]	1. Limit access to wellhead to authorized personnel only. 2. Initiate immediate shutdown plan. 3. Within 24 hours of the incident, notify the UIC Program Director of the operating status of the well.

[4] Onset of damage is defined as cosmetic damage to structures, such as bricks dislodged from chimneys and parapet walls, broken windows, and fallen objects from walls, shelves, and cabinets.

Operating State	Threshold Condition[1,2]	Response Action[3]
	Seismic event >M3.5	4. Communicate with facility personnel and local authorities to initiate evacuation plans, as necessary. 5. Monitor well pressure, temperature, and annulus pressure to verify well status and determine the cause and extent of any failure; identify and implement appropriate remedial actions (in consultation with the UIC Program Director). 6. Determine if leaks to ground water or surface water or a CO_2 leak to the surface occurred. 7. If a CO_2 leak or USDW contamination/endangerment is detected: a. Notify the UIC Program Director within 24 hours of the determination and implement appropriate remedial actions in consultations with the Director. 8. Review seismic and operational data to determine location and magnitude of seismic event. If the event falls within or near the extents of the plume, use the microseismic, geomechanics and facies data to estimate potential impact to USDWs. Perform a pressure falloff test to determine if the storage complex has been compromised by the seismic event. 9. Report findings to the UIC Program Director and issue corrective actions. 10. Document the event for reporting to EPA in semiannual reports.

5. Response Personnel and Equipment

Site personnel, project personnel, and local authorities will be relied upon to implement this ERRP.

Site personnel to be notified (not listed in order of notification):

1. Emergency Coordinator 24-hour number—Control Room technician on duty: 559-655-4923
2. Plant Safety Manager - Clint Cooper: Office: (559) 655-3947; 24 hr: 559-916-2139
3. Alternate Facility Emergency Coordinator: Arnold Gonzales: Office: 559-655-4921, ext 12, mobile: 559-916-2142
4. Plant Manager

A site-specific emergency contact list will be developed and maintained during the life of the project. Clean Energy Systems will provide the current site-specific emergency contact list to the UIC Program Director. Contact information for local, state, and other authorities is given in Table 3.

Table 3. Contact information for key local, state, and other authorities.

Agency	**Phone Number**
Local police	911
Mendota Fire Department	911
Ambulance/Paramedics	911
Fresno Community Regional Medical Center	24 hr 559-459-6000
Poison Control Center	800-342-9293
California Office of Emergency Services	24 hr 800-852-7550
State Water Quality Control Board (Central Valley)	916-255-3000
Environmental services contractor - Schlumberger	661-864-4700
UIC Program Director	Not yet assigned
EPA National Response Center (24 hours)	800-424-8802
State geological survey	916-322-1080

Equipment needed in the event of an emergency and remedial response will vary, depending on the triggering emergency event. Response actions (cessation of injection, well shut-in, and evacuation) will generally not require specialized equipment to implement. Where specialized equipment (such as a drilling rig or logging equipment) is required, Clean Energy Systems shall be responsible for its procurement.

6. Emergency Communications Plan

Clean Energy Systems will communicate to the public about any event that requires an emergency response to ensure that the public understands what happened and whether there are any environmental or safety implications. The amount of information, timing, and communications method(s) will be appropriate to the event, its severity, whether any impacts to drinking water or other environmental resources occurred, any impacts to the surrounding community, and their awareness of the event.

Clean Energy Systems will describe what happened, any impacts to the environment or other local resources, how the event was investigated, what responses were taken, and the status of the response. For responses that occur over the long-term (e. g., ongoing cleanups), Clean Energy Systems will provide periodic updates on the progress of the response action(s).

Clean Energy Systems will also communicate with entities who may need to be informed about or take action in response to the event, including local water systems, CO_2 source(s) and pipeline operators, landowners, and Regional Response Teams (as part of the National Response Team).

7. Plan Review

This ERRP shall be reviewed:

- At least once every five (5) years following its approval by the permitting agency
- Within one (1) year of an area of review (AOR) reevaluation
- Within 30 days, or other time prescribed by the EPA Director, following any significant changes to the injection process or the injection facility, or an emergency event
- As required by the permitting agency

If the review indicates that no amendments to the ERRP are necessary, Clean Energy Systems will provide the permitting agency with the documentation supporting the "no amendment necessary" determination.

If the review indicates that amendments to the ERRP are necessary, amendments shall be made and submitted to the permitting agency within 30 days, or other time prescribed by the EPA Director, following an event that initiates the ERRP review procedure.

8. Staff Training and Exercise Procedures

CES will integrate the ERRP into the storage site-specific standard operating procedures and training program:

- Periodic training will be provided, not less than annually.

- Training will be provided to well operators, plant safety and environmental personnel, the plant manager, plant superintendent, and corporate communications. The training plan will document that the above-listed personnel have been trained and possess the required skills to perform their relevant emergency response activities described in the ERRP.

9. References

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10. Appendix A: CES Project Preliminary Risk Register

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CES Project Preliminary Risk Register

Risk Level	
Black	**Extreme:** Stop the tasks/processes. Significant Action Plan required.
Red	**High:** Significant Action Plan required.
Yellow	**Medium:** Action Plan required.
Green	**Low:** Proceed carefully. Action Plan may but warranted but not required.
Blue	**Insignificant:** Safe to proceed. Action Plan not required.

Identification								Qualitative Analysis			Risk Response								
Risk Number	Date Identified	Identified By	Project Phase	Description of Risk	Risk Trigger(s)	Risk Type	Risk Category	Likelihood	Severity	Risk Matrix	Strategy	Strategy Action Plan/Response Plan	Category	Assigned to	Avoidance Measures	Response Personnel	Equipment	Status	Risk Number
1a		Schlumberger	Drilling	Over-pressurized fluid (blowout) during well construction	1. Pocket of high pressure gas or fluid encountered during drilling.	Drilling	HS	Very Low	Catastrophic	Likelihood: Very Low / Low / Medium / High / Very High; Severity: Light / Serious / Major / Catastrophic / Multi-Catastrophic; X at Catastrophic × Very Low	Mitigation	Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator			1a
											Mitigation	Cease drilling operations: loss of drilling fluid due to lost circulation and/or drilling into an over-pressured formation.	Major/Serious, Minor	Well Eng.	Monitoring	Well Eng., Project Mgr.		Open	
											Mitigation	Initiate well control procedures (see well plan).	Major/Serious, Minor	Well Eng.	Monitoring	Well Eng., Project Mgr.	Pressure Control equipment	Open	
											Mitigation	Close flow valve (blowout preventer) if considered appropriate not to damage well and USDW.	Major/Serious, Minor	Well Eng.	Monitoring	Well Eng., Project Mgr.		Open	
											Mitigation	Regain pressure control by restoring fluid levels in the wellbore with appropriate density mud, restriction of flow through choke or both.	Major/Serious/Minor	Well Eng.	Monitoring	Well Eng., Project Mgr.	Pumping Equipment, Rig	Open	
											Mitigation	Alert local fire and police and UIC Program Director immediately.	Major/Serious	Well Eng.	Monitoring	Well Eng., Project Mgr.		Open	
											Mitigation	Determine cause of event and initiate remediation procedures.	Minor	Well Eng.	Monitoring	Well Eng., Project Mgr.	Pumping Equipment, Rig	Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Well Eng.	Monitoring	Well Eng., Project Mgr.		Open	
2a		Schlumberger	Injecting/Monitoring	Injection or monitoring (verification) well integrity failure	1. Wellhead pressure exceeds the specified shutdown pressure specified in the permit.	Equipment	HS	Low	Light	Likelihood: Very Low / Low / Medium / High / Very High; Severity: Light / Serious / Major / Catastrophic / Multi-Catastrophic; X at Light × Low	Mitigation	Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator			2a
											Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.	Major/Serious, Minor	Well Eng., Project Mgr.	Monitoring	Well Eng., Project Mgr.		Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Project Mgr.	Monitoring	Project Mgr.		Open	
											Mitigation	Initiate immediate shutdown plan.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Shut in well (close flow valve). After verifying pressures will not damage well or USDW.	Major/Serious	Site Operator	Monitoring	Site Operator	Wireline	Open	
											Mitigation	Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause, location and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).	Major/Serious	Well Eng	Monitoring	Well Eng	Wireline logs, workover rig	Open	
											Mitigation	Communicate with CES personnel and local authorities to initiate evacuation plans, as necessary.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Evaluate, test sensors to determine they are functioning properly. If sensors are determined faulty or in need of maintenance commence repair/replacement operations. (in consultation with the UIC Program Director restart injecton).	Minor	Site Operator	Maintenance	Site Operator		Open	
											Mitigation	Vent fluids, if needed to maintain acceptable pressures as surface and downhole as not to damage the wellhead or casing.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	If contamination is detected, identify and implement appropriate remedial actions (in consultation with the UIC Program Director).	Major/Serious	Project Mgr.	Monitoring	Project Mgr.		Open	
											Mitigation	Conduct assessment to determine whether there has been a loss of mechanical integrity.	Minor	Well Eng/Site Operator	Monitoring	Well Eng	Wireline logs	Open	
											Mitigation	If there has been a loss of mechanical integrity, initiate shutdown plan. Provided there is sufficient mechanical intergrity to contain pressures. May need to allow Packer fluid into reservoir and keep well full with fluid in mechanical integrity permits.	Minor	Well Eng/Site Operator	Monitoring	Well Eng	Workover rig to pull tubing if required	Open	
											Mitigation	Reset automatic shutdown devices.	Minor	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	If a shut off is triggered by mechanical or electrical malfunctions without endangering a USDW, repair faulty components. electrical malfunctions without endangering a USDW, repair faulty components. Verify with analog gauges.	Minor	Well Eng., Project Mgr.	Monitoring/Maintenance	Well Eng., Project Mgr.		Open	
2b		Schlumberger	Injecting/Monitoring	Injection or monitoring (verification) well integrity failure	1. Annulus pressure indicates a loss of external or internal well containment.	Equipment	HS	Low	Serious	Likelihood: Very Low / Low / Medium / High / Very High; Severity: Light / Serious / Major / Catastrophic / Multi-Catastrophic; X at Serious × Low	Mitigation	Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator			2b
											Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Project Mgr.		Project Mgr.		Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Project Mgr.	Monitoring	Project Mgr.		Open	
											Mitigation	Initiate immediate shutdown plan.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Shut in well (close flow valve). After verifying pressures will not damage well or USDW. Allow packer fluid into reservoir to stop CO2 flow and keep well full with proper density fluid if required.	Major/Serious	Site Operator	Monitoring	Site Operator	Wireline, Workover rig to pull tubing if required	Open	
											Mitigation	Vent fluids, if needed, to maintain reasonable wellbore and surface facilities pressures.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Communicate with CES personnel and local authorities to initiate evacuation plans, as necessary.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).	Major/Serious	Well Engineer	Monitoring	Well Engineer	Wireline logs, workover rig	Open	
											Mitigation	If contamination is detected, identify and implement appropriate remedial actions (in consultation with the UIC Program Director).	Major/Serious	Well Engineer, Project Mgr	Monitoring	Well Engineer		Open	
											Mitigation	Conduct assessment to determine whether there has been a loss of mechanical integrity.	Minor	Well Engineer	Monitoring	Well Engineer	Wireline logs	Open	
											Mitigation	If there has been a loss of mechanical integrity, prepare well for longer term shutdown to get repairs accomplished. May include plugs.	Minor	Well Engineer	Monitoring	Well Engineer	Workover rig to set plugs if require	Open	
											Mitigation	Vent fluids f from wellhead in order to maintain acceptable pressures as surface and downhole as not to damage the wellhead or casing.	Minor	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Reset automatic shutdown devices.	Minor	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).	Minor	Well Engineer	Monitoring	Well Engineer	Wireline logs, workover rig	Open	
											Mitigation	If a shut off is triggered by mechanical or electrical malfunctions without endangering a USDW, repair faulty components. electrical malfunctions without endangering a USDW, repair faulty components. Verify with analog gauges.	Minor	Site Operator	Monitoring/Maintenance	Site Operator		Open	
2c		Schlumberger	Injecting/Monitoring	Injection or monitoring (verification) well integrity failure	1. Mechanical integrity test results identify a loss of mechanical integrity.	Equipment	HS	Very Low	Catastrophic	Likelihood: Very Low / Low / Medium / High / Very High; Severity: Light / Serious / Major / Catastrophic / Multi-Catastrophic; X at Catastrophic × Very Low	Mitigation	Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator			2c
											Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Project Mgr.		Project Mgr.		Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Project Mgr.	Monitoring	Project Mgr.		Open	
											Mitigation	Initiate immediate shutdown plan.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Shut in well (close flow valve). After verifying pressures will not damage well or USDW. Need to verify best method to shut in well so that the mechanical integrity issues are not a factor such as allowing packer fluid to flow to reservoir and keep well full of liquid.	Major/Serious	Site Operator	Monitoring	Site Operator	Wireline logs, workover rig	Open	
											Mitigation	Vent fluids if needed, to maintain reasonable wellbore and surface facilities pressures.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Communicate with CES personnel and local authorities to initiate evacuation plans, as necessary.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).	Major/Serious	Well Engineer	Monitoring	Well Engineer	Workover rig	Open	
											Mitigation	If contamination is detected, identify and implement appropriate remedial actions (in consultation with the UIC Program Director).	Major/Serious	Well Engineer, Project Mgr	Monitoring	Well Engineer		Open	
											Mitigation	Conduct assessment to determine whether there has been a loss of mechanical integrity.	Minor	Well Engineer	Monitoring	Well Engineer	Wireline logs	Open	
											Mitigation	If there has been a loss of mechanical integrity, prepare well for longer term shutdown to get repairs accomplished. May include plugs.	Minor	Well Engineer	Monitoring	Well Engineer	Workover rig to set plugs if required	Open	
											Mitigation	Reset automatic shutdown devices.	Minor	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	If there is damage to the wellhead, repair the damage and conduct a survey to ensure wellhead leakage has ceased.	Minor	Well Engineer	Monitoring	Well Engineer		Open	
											Mitigation	Confirm well integrity prior to restarting injection (upon approval of the UIC Program Director).	Minor	Well Engineer	Monitoring	Well Engineer	Wireline logs	Open	
											Mitigation	Review downhole, wellhead, and annulus pressure data.	Major/Serious	Well Engineer	Monitoring	Well Engineer		Open	
											Mitigation	Isolate the nearby area, if needed; establish a safe distance and perimeter using a hand-held air-quality monitor.	Major/Serious	Well Engineer	Monitoring	Well Engineer	Hand-held air quality monitor	Open	
											Mitigation	Perform a well log/MIT to detect CO2 movement outside of the casing.	Major/Serious	Well Engineer	Monitoring	Well Engineer	Well log/MIT	Open	
											Mitigation	If a shut off is triggered by mechanical or electrical malfunctions without endangering a USDW, repair faulty components. electrical malfunctions without endangering a USDW, repair faulty components. Verify with analog gauges.	Minor	Site Operator	Monitoring/Maintenance	Site Operator		Open	

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CES Project Preliminary Risk Register

Risk Level	
Black	**Extreme:** Stop the tasks/processes. Significant Action Plan required.
Red	**High:** Significant Action Plan required.
Yellow	**Medium:** Action Plan required.
Green	**Low:** Proceed carefully. Action Plan may but warranted but not required.
Blue	**Insignificant:** Safe to proceed. Action Plan not required.

Identification								Qualitative Analysis			Risk Response								
Risk Number	Date Identified	Identified By	Project Phase	Description of Risk	Risk Trigger(s)	Risk Type	Risk Category	Likelihood	Severity	Risk Matrix	Strategy	Strategy Action Plan/Response Plan	Category	Assigned to	Avoidance Measures	Response Personnel	Equipment	Status	Risk Number
3a		Schlumberger	Injecting/Monitoring	Injection well monitoring equipment failure (e.g., shut-off valve or pressure gauge, etc.)	1. The failure of monitoring equipment for wellhead pressure, temperature, and/or annulus pressure may indicate a problem with the injection well that could endanger USDWs.	Equipment	HS	Medium	Light		Mitigation	Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	
											Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Project Mgr.	Monitoring	Project Mgr.		Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Project Mgr.	Monitoring	Project Mgr.		Open	
											Mitigation	Initiate immediate shutdown plan.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Shut in well (close flow valve). Allow packer fluid into reservoir to stop CO2 flow and keep well full with proper density fluid if required.	Major/Serious	Site Operator	Monitoring	Site Operator	Wireline, Workover rig to pull tubing if required	Open	
											Mitigation	Vent fluids, if needed, to maintain acceptable pressures as surface and downhole as not to damage the wellhead or casing.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Communicate with CES personnel and local authorities to initiate evacuation plans, as necessary.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Verify pressures and temperatures with analog guages.							
											Mitigation	Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).	Major/Serious	Well Engineer	Monitoring	Well Engineer	Wireline logs, workover rig	Open	
											Mitigation	If contamination is detected, identify and implement appropriate remedial actions (in consultation with the UIC Program Director).	Major/Serious	Well Engineer, Project Mgr	Monitoring	Well Engineer, Project Mgr.		Open	
											Mitigation	Conduct assessment to determine whether there has been a loss of mechanical integrity.	Minor	Well Engineer	Monitoring	Well Engineer	Wireline logs	Open	
											Mitigation	If there has been a loss of mechanical integrity, prepare well for longer term shutdown to get repairs accomplished. May include plugs.	Minor	Well Engineer	Monitoring	Well Engineer	Workover rig to set plugs if required	Open	
											Mitigation	Shut in well (close flow valve). Allow packer fluid into reservoir to stop CO2 flow and keep well full.	Minor	Well Engineer	Monitoring	Well Engineer	Workover rig to pull tubing if required	Open	
											Mitigation	Vent fluids f from wellhead in order to maintain acceptable pressures as surface and downhole as not to damage the wellhead or casing.	Minor	Well Engineer	Monitoring	Well Engineer		Open	
											Mitigation	Reset automatic shutdown devices.	Minor	Well Engineer	Monitoring	Well Engineer		Open	
											Mitigation	Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).	Minor	Well Engineer	Monitoring	Well Engineer	Wireline logs, workover rig	Open	
											Mitigation	If there is damage to the wellhead, repair the damage and conduct a survey to ensure wellhead leakage has ceased.	Minor	Well Engineer	Monitoring	Well Engineer	Workover rig	Open	
											Mitigation	Confirm well integrity prior to restarting injection (upon approval of the UIC Program Director).	Minor	Well Engineer	Monitoring	Well Engineer	Wireline logs	Open	
											Mitigation	Review downhole, wellhead, and annulus pressure data.	Major/Serious	Well Engineer	Monitoring	Well Engineer		Open	
											Mitigation	Isolate the nearby area, if needed; establish a safe distance and perimeter using a hand-held air-quality monitor.	Major/Serious	Well Engineer	Monitoring	Well Engineer	Hand-held air quality monitor	Open	
											Mitigation	Perform a well log/MIT to detect CO2 movement outside of the casing.	Major/Serious	Well Engineer	Monitoring	Well Engineer	Well log/MIT	Open	
3b		Schlumberger	Injecting/Monitoring	Injection well monitoring equipment failure (e.g., shut-off valve or pressure gauge, etc.)	1. Equipment failures (sensor, computer, cabling, etc) and damage to wellhead (ran over by heavy equipment).	Equipment	HS	Very Low	Catastrophic		Mitigation	Limit access to wellhead to authorized personnel only		Site Operator	Signage	Site Operator		Open	
											Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Project Mgr.	Monitoring	Project Mgr.		Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Project Mgr.	Monitoring	Project Mgr.		Open	
											Mitigation	Initiate immediate shutdown plan.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Shut in well (close flow valve). Allow packer fluid into reservoir to stop CO2 flow and keep well full with proper density fluid.	Major/Serious	Site Operator	Monitoring	Site Operator	Workover rig to pull tubing if required	Open	
											Mitigation	Vent fluids f from wellhead in order to maintain acceptable pressures as surface and downhole as not to damage the wellhead or casing, if possible.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Communicate with CES personnel and local authorities to initiate evacuation plans, as necessary.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).	Major/Serious	Well Engineer	Monitoring	Well Engineer		Open	
											Mitigation	If contamination is detected, identify and implement appropriate remedial actions (in consultation with the UIC Program Director).	Major/Serious	Well Engineer, Project Mgr	Monitoring	Well Engineer, Project Mgr.		Open	
											Mitigation	Conduct assessment to determine whether there has been a loss of mechanical integrity.	Minor	Well Engineer	Monitoring	Well Engineer	Wireline logs	Open	
											Mitigation	If there has been a loss of mechanical integrity, prepare well for longer term shutdown to get repairs accomplished. May include plugs	Minor	Well Engineer	Monitoring	Well Engineer	Workover rig to set plugs if required	Open	
											Mitigation	Reset automatic shutdown devices.	Minor	Well Engineer	Monitoring	Well Engineer		Open	
											Mitigation	Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).	Minor	Well Engineer	Monitoring	Well Engineer	Wireline logs, workover rig	Open	
											Mitigation	If there is damage to the wellhead, repair the damage and conduct a survey to ensure wellhead leakage has ceased.	Minor	Well Engineer	Monitoring	Well Engineer	Workover rig	Open	
											Mitigation	Confirm well integrity prior to restarting injection (upon approval of the UIC Program Director).	Minor	Well Engineer	Monitoring	Well Engineer	Wireline logs	Open	
											Mitigation	Review downhole, wellhead, and annulus pressure data.	Major/Serious	Well Engineer	Monitoring	Well Engineer		Open	
											Mitigation	Isolate the nearby area, if needed; establish a safe distance and perimeter using a hand-held air-quality monitor.	Major/Serious	Well Engineer	Monitoring	Well Engineer	Hand-held air quality monitor	Open	
											Mitigation	Perform a well log/MIT to detect CO2 movement outside of the casing.	Major/Serious	Well Engineer	Monitoring	Well Engineer	Well log/MIT	Open	

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CES Project Preliminary Risk Register

Risk Level	
Black	**Extreme:** Stop the tasks/processes. Significant Action Plan required.
Red	**High:** Significant Action Plan required.
Yellow	**Medium:** Action Plan required.
Green	**Low:** Proceed carefully. Action Plan may but warranted but not required.
Blue	**Insignificant:** Safe to proceed. Action Plan not required.

Identification								Qualitative Analysis			Risk Response								
Risk Number	Date Identified	Identified By	Project Phase	Description of Risk	Risk Trigger(s)	Risk Type	Risk Category	Likelihood	Severity	Risk Matrix	Strategy	Strategy Action Plan/Response Plan	Category	Assigned to	Avoidance Measures	Response Personnel	Equipment	Status	Risk Number
4a		Schlumberger	Throughout	Fluid (e.g. brine) leakage to a USDW	1. Any evidence of fluid movement out of the injection zone (i.e., not necessarily to a USDW) to address unanticipated events associated with faults or other pathways; any potential USDW endangerment/unacceptable changes in water quality; and CO2 leakage to the land surface.	Leakage	Environmental	Very Low	Catastrophic	Likelihood: Very Low / Low / Medium / High / Very High; Severity: Light / Serious / Major / Catastrophic / Multi-Catastrophic; X = Catastrophic × Very Low	Mitigation	Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	4a
											Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Site Operator	Monitoring	Project Mgr.		Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Site Operator	Monitoring	Project Mgr.		Open	
											Mitigation	Initiate shutdown of plant.	Major/Serious/Minor	Site Operator	Monitoring	Site Operator		Open	
												If the presence of indicator parameters is confirmed, develop (in consultation with the UIC Program Director) a case-specific work plan to:		Site Operator	Monitoring	Project Mgr.		Open	
											Mitigation	Install additional groundwater monitoring points near the affected groundwater well(s) to delineate the extent of impact; and	Major/Serious/Minor	GW Consultant	Monitoring	GW Consultant		Open	
											Mitigation	Remediate unacceptable impacts to the affected USDW.	Major/Serious/Minor	GW Consultant	Monitoring	GW Consultant		Open	
											Mitigation	Arrange for an alternate potable water supply, if the USDW was being utilized and has been caused to exceed drinking water standards.	Major/Serious/Minor	GW Consultant	Monitoring	GW Consultant		Open	
											Mitigation	Proceed with efforts to remediate USDW to mitigate any unsafe conditions (e.g., install system to intercept/extract brine or CO2or "pump and treat" to aerate CO2-laden water).	Major/Serious/Minor	GW Consultant	Monitoring	GW Consultant		Open	
											Mitigation	Continue groundwater remediation and monitoring on a frequent basis (frequency to be determined by Clean Energy Systems and the UIC Program Director) until unacceptable adverse USDW impact has been fully addressed.	Major/Serious/Minor	GW Consultant	Monitoring	GW Consultant		Open	
											Mitigation	Address a well integrity issue, including taking specific steps to identify the location of the failure/leak, affect repairs, and demonstrate M.I.	Major/Serious/Minor	Well Eng., Project Mgr.	Monitoring	Well Eng., Project Mgr.		Open	
											Mitigation	Isolate the nearby area, if needed; establish a safe distance and perimeter using a hand-held air-quality monitor.	Major/Serious/Minor	Site Operator	Monitoring	Air monitoring	Hand-held air quality monitor	Open	
4b		Schlumberger	Throughout	Fluid (e.g. CO2) leakage to a USDW	1. Any evidence of CO2 movement out of the injection zone (i.e., not necessarily to a USDW) to address unanticipated events associated with faults or other pathways; any potential USDW endangerment/unacceptable changes in water quality; and CO2 leakage to the land surface.	Leakage	Environmental	Very Low	Catastrophic	Likelihood: Very Low / Low / Medium / High / Very High; Severity: Light / Serious / Major / Catastrophic / Multi-Catastrophic; X = Catastrophic × Very Low		Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	4b
											Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Site Operator	Monitoring	Project Mgr.		Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Site Operator	Monitoring	Project Mgr.		Open	
											Mitigation	Initiate shutdown plan.	Major/Serious/Minor	Site Operator	Monitoring	Site Operator		Open	
												If the presence of indicator parameters is confirmed, develop (in consultation with the UIC Program Director) a case-specific work plan to:		Site Operator	Monitoring	Project Mgr.		Open	
											Mitigation	Install additional groundwater monitoring points near the affected groundwater well(s) to delineate the extent of impact; and	Major/Serious/Minor	GW Consultant	Monitoring	GW Consultant		Open	
											Mitigation	Remediate unacceptable impacts to the affected USDW.	Major/Serious/Minor	GW Consultant	Monitoring	GW Consultant		Open	
											Mitigation	Arrange for an alternate potable water supply, if the USDW was being utilized and has been caused to exceed drinking water standards.	Major/Serious/Minor	GW Consultant	Monitoring	GW Consultant		Open	
											Mitigation	Proceed with efforts to remediate USDW to mitigate any unsafe conditions (e.g., install system to intercept/extract brine or CO2or "pump and treat" to aerate CO2-laden water).	Major/Serious/Minor	GW Consultant	Monitoring	GW Consultant		Open	
											Mitigation	Continue groundwater remediation and monitoring on a frequent basis (frequency to be determined by Clean Energy Systems and the UIC Program Director) until unacceptable adverse USDW impact has been fully addressed.	Major/Serious/Minor	GW Consultant	Monitoring	GW Consultant		Open	
											Mitigation	Address a well integrity issue, including taking specific steps to identify the location of the failure/leak, affect repairs, and demonstrate M.I.	Major/Serious/Minor	Well Eng., Project Mgr.	Monitoring	Well Eng., Project Mgr.		Open	
											Mitigation	Isolate the nearby area, if needed; establish a safe distance and perimeter using a hand-held air-quality monitor.	Major/Serious/Minor	Site Operator	Fence	Air monitoring	Hand-held air quality monitor	Open	
5a		Schlumberger	Throughout	A natural disaster (e.g., earthquake, tornado, lightning strike)	1. Well problems (integrity loss, leakage, or malfunction) may arise as a result of a natural disaster affecting the normal operation of the injection well. An earthquake may disturb surface and/or subsurface facilities; and weather-related disasters (e.g., tornado or lightning strike) may affect surface facilities.	Natural	Environmental	Low	Catastrophic	Likelihood: Very Low / Low / Medium / High / Very High; Severity: Light / Serious / Major / Catastrophic / Multi-Catastrophic; X = Catastrophic × Low		Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	5a
											Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Initiate immediate shutdown plan.	Major/Serious	Site Operator	Preventative Operation	Site Operator		Open	
											Mitigation	Shut in well (close flow valve).	Major/Serious/Minor	Site Operator	Preventative Operation	Site Operator		Open	
											Mitigation	Vent CO2 from surface facilities if appropriate.	Major/Serious/Minor	Site Operator	Preventative Operation	Site Operator		Open	
											Mitigation	Communicate with CES personnel and local authorities to initiate evacuation plans, as necessary.	Major/Serious	Site Operator	Monitoring			Open	
											Mitigation	Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).	Major/Serious		Monitoring			Open	
											Mitigation	Determine if any leaks to ground water or surface water occurred.	Major/Serious	GW Consultant	Monitoring	GW Consultant		Open	
											Mitigation	If contamination is detected, identify and implement appropriate remedial actions (in consultation with the UIC Program Director).	Major/Serious	GW Consultant	Remedial Action	GW Consultant		Open	
											Mitigation	Conduct assessment to determine whether there has been a loss of mechanical integrity.	Minor	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	If there has been a loss of mechanical integrity, initiate shutdown plan.	Minor	Site Operator	Remedial Action	Site Operator		Open	
											Mitigation	If there has not been a loss of mechanical integrity, initiate gradual shutdown.	Minor	Site Operator	Remedial Action	Site Operator		Open	
											Mitigation	Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).	Minor	Site Operator	Monitoring	Site Operator		Open	

Schlumberger

CES Project Preliminary Risk Register

Risk Level	
Black	**Extreme:** Stop the tasks/processes. Significant Action Plan required.
Red	**High:** Significant Action Plan required.
Yellow	**Medium:** Action Plan required.
Green	**Low:** Proceed carefully. Action Plan may but warranted but not required.
Blue	**Insignificant:** Safe to proceed. Action Plan not required.

Identification								Qualitative Analysis		Risk Response						
6a		Schlumberger	Throughout or injection	Induced or natural seismic event	1. Injection operation inducing a seismic event equal to or less than M1.5	Seismic	Environmental	Medium	Light	Mitigation	Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	6a
										Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Site Operator	Monitoring	Site Operator		Open	
										Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).		Site Operator	Monitoring	Site Operator		Open	
										Mitigation	Continue normal operation within permitted levels.	Minor	Site Operator		Site Operator		Open	
										Mitigation	Document the event for reporting to EPA in semiannual reports.	Minor	Site Operator		Site Operator/Microseimic Provider	Microseismic monitoring	Open	
6b		Schlumberger	Throughout or injection	Induced or natural seismic event	1. Five (5) or more seismic events within a 30-day period having a magnitude greater than M1.5 but less than or equal to M2.0	Seismic	Environmental	Medium	Light	Mitigation	Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	6b
										Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Site Operator	Monitoring	Site Operator		Open	
										Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Site Operator	Monitoring	Site Operator		Open	
										Mitigation	Continue normal operation within permitted levels.	Minor	Site Operator		Site Operator		Open	
										Mitigation	Initiate gradual shutdown of the well if it is determined to be appropriate.	Minor	Site Operator		Site Operator		Open	
											Review seismic and operational data to determine location and magnitude of seismic event. If the event falls within or near the extents of the plume, use the microseismic, geomechanics and facies data to estimate potential impact to USDWs. Perform a pressure fall-off test to determine if the storage complex has been comprimomised by the seismic event.	Minor	Microseismic provider		Site Operator	Microseismic monitoring, fall-off test	Open	
											Report findings to the UIC Program Director and issue corrective actions.	Minor	Site Operator		Site Operator		Open	
											Document the event for reporting to EPA in semiannual reports.	Minor	Site Operator		Site Operator/Microseimic Provider	Microseismic monitoring	Open	
6c		Schlumberger	Throughout or injection	Induced or natural seismic event	1. Seismic event greater than M1.5 and local observation or felt report.	Seismic	Environmental	Medium	Major	Mitigation	Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	6c
										Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Site Operator	Monitoring	Site Operator		Open	
										Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Site Operator	Monitoring	Site Operator		Open	
										Mitigation	Continue normal operation within permitted levels.	Minor	Site Operator		Site Operator		Open	
										Mitigation	Initiate gradual shutdown of the well if it is determined to be appropriate.	Minor	Site Operator		Site Operator		Open	
											Review seismic and operational data to determine location and magnitude of seismic event. If the event falls within or near the extents of the plume, use the microseismic, geomechanics and facies data to estimate potential impact to USDWs. Perform a pressure fall-off test to determine if the storage complex has been comprimomised by the seismic event.	Minor	Microseismic provider		Site Operator	Microseismic monitoring, fall-off test	Open	
											Report findings to the UIC Program Director and issue corrective actions.	Minor	Site Operator		Site Operator		Open	
											Document the event for reporting to EPA in semiannual reports.	Minor	Site Operator		Site Operator/Microseimic Provider	Microseismic monitoring	Open	
6c		Schlumberger	Throughout or injection	Induced or natural seismic event	1. Seismic event greater than M2.0 and no felt report	Seismic	Environmental	Low	Light	Mitigation	Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	6c
										Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Site Operator	Monitoring	Site Operator		Open	
										Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Site Operator	Monitoring	Site Operator		Open	
										Mitigation	Continue normal operation within permitted levels.	Minor	Site Operator		Site Operator		Open	
										Mitigation	Initiate gradual shutdown of the well if it is determined to be appropriate.	Minor	Site Operator		Site Operator		Open	
											Review seismic and operational data to determine location and magnitude of seismic event. If the event falls within or near the extents of the plume, use the microseismic, geomechanics and facies data to estimate potential impact to USDWs. Perform a pressure fall-off test to determine if the storage complex has been compromised by the seismic event.	Minor	Microseismic provider		Site Operator	Microseismic monitoring, fall-off test	Open	
											Report findings to the UIC Program Director and issue corrective actions.	Minor	Site Operator		Site Operator		Open	
											Document the event for reporting to EPA in semiannual reports.	Minor	Site Operator		Site Operator/Microseimic Provider	Microseismic monitoring	Open	
6d		Schlumberger	Throughout or injection	Induced or natural seismic event	1. Seismic event greater than M2.0 and local observation or report	Seismic	Environmental	Low	Major	Mitigation	Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	6d
										Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Site Operator	Monitoring	Site Operator		Open	
										Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Site Operator	Monitoring	Site Operator		Open	
										Mitigation	Initiate gradual shutdown of the well if it is determined to be appropriate.	Minor	Site Operator		Site Operator		Open	
										Mitigation	Communicate with facility personnel and local authorities to initiate evacuation plans, as necessary.	Minor	Site Operator	Monitoring	Site Operator		Open	
										Mitigation	Monitor well pressure, temperature, and annulus pressure to verify well status and determine the cause and extent of any failure; identify and implement appropriate remedial actions (in consultation with the UIC Program Director).	Minor	Site Operator		Site Operator		Open	
										Mitigation	Determine if leaks to ground water or surface water or a CO2 leak to the surface occurred.	Major/Serious	GW Consultant		GW Consultant		Open	
										Mitigation	If a CO2 leak or USDW contamination/endangerment is detected: Notify the UIC Program Director within 24 hours of the determination and implement appropriate remedial actions in consultations with the Director.		Site Operator		Site Operator		Open	
										Mitigation	Review seismic and operational data to determine location and magnitude of seismic event. If the event falls within or near the extents of the plume, use the microseismic, geomechanics and facies data to estimate potential impact to USDWs. Perform a pressure fall-off test to determine if the storage complex has been compromised by the seismic event.		Microseismic provider		Site Operator	Microseismic monitoring, fall-off test	Open	
										Mitigation	Report findings to the UIC Program Director and issue corrective actions.		Site Operator		Site Operator		Open	
										Mitigation	Document the event for reporting to EPA in semiannual reports.	Minor	Site Operator		Site Operator/Microseimic Provider	Microseismic monitoring	Open	
6e		Schlumberger	Throughout or injection	Induced or natural seismic event	1. Seismic event greater than M2.0,and local observation or report, andlocal report and confirmation of damage . 2. Seismic event >M3.5	Seismic	Environmental	Low	Catastrophic	Mitigation	Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	6e
										Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Site Operator		Site Operator		Open	
										Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Site Operator		Site Operator		Open	
										Mitigation	Initiate immediate shutdown plan.	Minor	Site Operator		Site Operator		Open	
										Mitigation	Communicate with facility personnel and local authorities to initiate evacuation plans, as necessary.	Minor	Site Operator		Site Operator		Open	
										Mitigation	Monitor well pressure, temperature, and annulus pressure to verify well status and determine the cause and extent of any failure; identify and implement appropriate remedial actions (in consultation with the UIC Program Director).	Minor	Site Operator		Site Operator		Open	
										Mitigation	Determine if leaks to ground water or surface water or a CO2 leak to the surface occurred.	Major/Serious	GW Consultant		GW Consultant		Open	
										Mitigation	If a CO2 leak or USDW contamination/endangerment is detected: Notify the UIC Program Director within 24 hours of the determination and implement appropriate remedial actions in consultations with the Director.		Site Operator		Site Operator		Open	
										Mitigation	Review seismic and operational data to determine location and magnitude of seismic event. If the event falls within or near the extents of the plume, use the microseismic, geomechanics and facies data to estimate potential impact to USDWs. Perform a pressure fall-off test to determine if the storage complex has been compromised by the seismic event.		Microseismic provider		Site Operator	Microseismic monitoring, fall-off test	Open	
										Mitigation	Report findings to the UIC Program Director and issue corrective actions.		Site Operator		Site Operator		Open	
										Mitigation	Document the event for reporting to EPA in semiannual reports.	Minor	Site Operator		Site Operator/Microseimic Provider	Microseismic monitoring	Open	